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EVALUATION OF VOR-AIR DEVICE, A RETRO-FIT EGR SYSTEM

Henry L. Gompf

Environmental Protection Agency
Ann Arbor, Michigan

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Henry L. Gompf

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16. Abstracts
An evaluation was initiated on an exhaust gas recirculation retrofit device developed by Vor-Air, Inc. This system was basically a simple exhaust gas recirculation device with the addition of an air-bleed system. Exhaust was picked up from the exhaust manifold and piped through a control valve to the PCV line for introduction into the intake manifold. In addition, filtered air from the air cleaner housing was allowed to mix with the EGR flow into the PCV line. Baseline and device tests were performed according to the 1972 Federal emission test procedure, using a 1970 Plymouth Valiant equipped with an automatic transmission and 225 CID six-cylinder engine. Test results, which are tabulated, indicate the following conclusions: Vor-Air demonstrated significant control of nitrogen oxides; No adverse effect on hydrocarbon or carbon monoxide levels was detected; Optimization of EGR vs. bleed air flow rates might lead to better overall emission control; Durability and driveability effects of the system should be quantified.

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Henry L. Gompf
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Background

Vor-Air Inc. of Las Vegas, Nevada, contacted the Office of Air Programs and requested an evaluation of an exhaust gas recirculation retrofit device currently under development. Data was presented from Scott Laboratories, Inc. of San Bernardino, California, compiled using a 1969 Ford Mustang. The results of this testing indicated a 23% reduction in carbon monoxide and a 38% reduction in oxides of nitrogen. The change in hydrocarbon level was negligible. An evaluation of the Vor-Air system was initiated by the Test and Evaluation Branch.

Device Description

The Vor-Air system tested was basically a simple exhaust gas recirculation device with the addition of an air-bleed system. Exhaust was picked up from the exhaust manifold and piped through a control valve to the PCV line for introduction into the intake manifold. In addition filtered air from the air cleaner housing was allowed to mix with the EGR flow into the PCV line.

EGR flow was allowed at idle and increased with decreasing manifold vacuum. No measure of the absolute EGR or bleed air rates have yet been made. Two different orifice plates were tested in the control valve to optimize the relative carbon monoxide-oxides of nitrogen control, by altering the amount of EGR flow and hence filtered air-flow rate.

The system requires about 45 minutes to install. Total installed cost to the consumer would probably be less than thirty-five dollars.

Test Program

Baseline and device tests were performed using a 1970 Plymouth Valiant equipped with an automatic transmission and 225 CID six-cylinder engine. All testing was conducted in accordance with the 1972 Federal emission test procedure as described in the November 10, 1970, Federal Register.

Test Results

The results of baseline and device testing (small and large orifice in the control valve) are presented in the Appendix of the report. These results can be summarized as follows:

Percent Reduction from Baseline

	HC	CO	CO_2	NOx
Large Orifice	2%	11%	5%	46%
Small Orifice	-6%*	3%	4%	42%

*increase

In addition to substantial reduction in the oxides of nitrogen level, the data indicates a potential fuel economy benefit with the system installed. Changes in hydrocarbon and carbon monoxide levels were not significantly different from usual test variability.

Conclusions

1. Vor-Air demonstrated significant control of oxides of nitrogen during the EPA evaluation.

2. No adverse effect on hydrocarbon or carbon monoxide levels was detected.

3. Optimization of EGR vs. bleed air flow rates might lead to better overall emission control.

4. Durability and driveability effects of the system should be quantified to better assess the full potential and applicability of the system.

Vor-Air 1972 FTP Emission Results
(all results in grams per mile)

	HC	CO	CO_2	NOx
Baseline				
8/03/72	2.66	41.54	440.09	5.53
8/04/72	2.18	35.33	444.85	5.46
Average	2.42	38.44	442.47	5.50
Vor-Air Large Orifice				
7/25/72	2.44	34.04	439.39	3.01
7/27/72	2.29	34.40	40.520	2.88
Average	2.37	34.22	422.30	2.95
Percent Reduction	2%	11%	5%	46%
Vor-Air Small Orifice				
7/31/72	2.71	40.10	414.06	3.08
8/01/72	2.40	34.81	439.71	3.30
Average	2.56	37.46	426.89	3.19
Percent Reduction	-6%*	3%	4%	42%

*increase